CHAPTER II

UNDERSTANDING THE KINDS OF REVISIONS NECESSARY FOR ADDRESSING CRITICISMS OF THE NATIONAL ACCOUNTS

National accounting systems serve as an information framework for analyzing the economy. They are designed to perform many of the same functions for the economy that private accounting does for individual business enterprises. Business managers use accounting methods to help in managing their day-to-day operations and assessing long-term practicability. Policymakers examine quarterly changes in national income totals to guide stabilization policies aimed at dampening swings in the business cycle. Policymakers also use such measures as the saving rate and the amount of capital formation recorded in the accounts to guide their assessment of the long-term performance of the economy.

Even though natural resources and the environment are not given the same treatment as privately owned physical capital in the current accounts, some economists would not advocate green accounting. There are at least two practical reasons for this resistance. One concern is maintaining consistency with historical time series from the national accounts. Another is maintaining the standards of the accounts; in large part these standards are thought to be upheld by using mostly market data. Can data be collected and measurements devised so that they meet the standards of the accounts for reliable and consistent assessments? These concerns are satisfied by separating out (in satellite accounts) the new estimates from official reported totals until a sufficient consensus develops around the consistency and integrity of new estimates. The United Nations is using this approach in its satellite system for integrated environmental and economic accounting as it begins green accounting efforts. The Bureau of Economic Analysis plans to build upon the work of the United Nations in developing an accounting framework that is consistent with the national accounts.

Given a decision to carry out some form of green accounting, the initial hurdle is determining just how to proceed. Which nonmarket services should be measured and which forms of natural capital (or other kinds of capital) should be depreciated? An important guiding principle is whether there are data and techniques available that make some revisions easier to carry out than others. Applying the analyses necessary to carry out some of the easier kinds of revisions could help inform decisionmakers about the impacts of some policies and lay a basis for more extensive revisions of the accounts.

In addition to addressing specific criticisms, revising the accounts to broaden the set of covered assets would allow for measures of sustainable income. In particular, such a revision would involve expanding the asset boundary to include every type of reproducible and natural capital. Within the framework of the national accounts, sustainability is related to maintaining wealth for the purpose of ensuring future income and consumption.

Basic accounting and economic concepts underlie the construction of the accounts that make them a powerful tool in economic analysis. Because it is important to continue to perform these traditional functions, any attempt to revise the accounts to measure changes in natural resources and the environment better should be attempted without upsetting the underlying framework. In order to understand the revisions involved in changing the national accounts, one must understand how they represent economic activity.

HOW THE NATIONAL ACCOUNTS REPRESENT ECONOMIC ACTIVITY

The national income and product accounts measure the flow of products and income in the U.S. economy. The *product side* of the national accounts measures the flow of goods and services produced in the economy. The *income side* of the accounts measures the income earned by factors (inputs) contributing to the production of these outputs. The two sides of the accounts represent two different measures of the same continuous flow.

The product side measures expenditures on output. The receipts from the sale of output then become payments compensating the factors that produced the output. For example, the amount spent on a loaf of bread at the supermarket becomes payment to the farmer, miller, baker, and supermarket owner for the labor and capital used in the production of the bread and their profits. Since the value of output equals income (a national accounting identity), gross domestic product can be viewed either as total expenditures on final output or as total income generated in production.

Intermediate Goods, Factor Services, and Final Goods and Services

A national accounting system must first measure the economic activity involved in the production of goods and services. Some products are sold to the final user. These products are called *final goods and services*. Other products are sold to be used in the production of other goods and services (that is, to be transformed and resold). These products are called *intermediate*

goods. Thus, wheat is an intermediate good used to produce flour, which in turn is used to produce bread. Here, bread is a final good because it is consumed rather than resold. In the case of natural resources and the environment, some of the goods and services may be intermediate and some may be final. For example, timber from forests, agricultural land, or minerals are sold and used in the production of other goods such as boards, agricultural commodities, or gasoline. They are intermediate goods. Drinking water, however, is a final good because it is sold to the final consumer.

The issue of double counting is critical to an accurate measure of national income. Clearly, GDP is not meant to include the value of the flour, yeast, milk, and other ingredients in a loaf of bread as well as the value of the loaf itself. Value added is another term for total input measured by total factor income for service provided.[1] Double counting is avoided in the accounts by working with value added. At each stage of manufacture of a good, only the value added to the good at that stage of production is counted as a part of GDP. The value of wheat (above the costs of purchased intermediate goods) sold by the farmer is counted as part of GDP. Then the value of flour sold by the miller minus the cost of the wheat is the miller's value added. Following the process along to the final good, the value of the bread is equal to the sum of value added at each stage.

Stocks and Flows in the Economy

An asset is any material or process that has the potential to generate a continuing flow of income.[2] A *stock* represents an asset at a particular point in time. Stocks generate flows as assets are used in the economy. *Flows* are the services generated by a stock during an accounting period (usually a year). The economic value of an asset is equal to the expected net present value of the flow of future services generated by the asset.

The Flow of Factor Services from Capital Stocks. The accounts assume that the production of any good or service can be linked to the flow of factor services provided by capital assets. Currently, the accounts recognize that the value of goods and services sold in the market includes the capital services of the plant and equipment used in their manufacture.

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1. GDP measured by final output should be equal to GDP measured by value added.

2. Irving Fischer, *The Nature of Capital and Income* (New York: Macmillan, 1906).

In a modern economy there are two general types of capital stock: reproducible and natural capital (see Table 1). Reproducible capital stock would not exist if humans did not inhabit the earth; in general, natural capital stock would anyway. Reproducible capital is subdivided into privately owned and publicly owned tangible and human capital.

Tangible reproducible capital includes computers, cranes, steel mills, textile plants, roads, and bridges. This form of capital stock is used by companies to manufacture such goods as automobiles and cookware, by governments and universities to provide medical and educational services, and by people for their personal housing.

Much publicly owned reproducible capital stock adds value to GDP. Human capital contributes to GDP as well. Human capital is a function of the total number of workers plus their skills and knowledge.

Natural capital consists of the environment and natural resource reserves. The environment as natural capital is made up of air (the atmosphere), water (the hydrosphere), and land (the lithosphere). The atmosphere absorbs greenhouse gases (carbon dioxide, methane, hydrofluorocarbons, and so on); ozone-depleting substances, including chlorofluorocarbons; emissions of particulate matter, nitrous oxides and sulphur oxides; and volatile organic compounds that contribute to atmospheric ozone. The hydrosphere absorbs such pollutants as heavy metals, chlorides, plastics, acid rain, pesticides, organic wastes, and chemical fertilizers. Paper, glass, metals, rubber products, plastics, pesticides, and chemical fertilizers are also deposited in the lithosphere. These waste disposal services directly affect the production of marketed goods and, therefore, affect GDP.

Natural capital provides marketed environmental waste disposal services and nonmarketed environmental waste disposal services. It is generally thought that the value added by environmental waste disposal services that are not marketed greatly exceeds the value added by marketed services.

Natural resources are a type of natural capital. Natural resources are divided into renewable and nonrenewable stocks. Renewable resources include agricultural lands, recreational areas, forests, lakes, streams, grasslands, wetlands, fisheries, and wildlife. These resources provide marketed factor services that serve as inputs for the production of final goods and services such as food, wood products, and drinking water and recreation.

TABLE 1. MAJOR SERVICE FLOWS FROM VARIOUS TYPES OF ASSETS AND CURRENT TREATMENT IN THE NATIONAL ACCOUNTS

	Category of Service Flow		
Type of Asset	Marketed Factor Services[a]	Nonmarketed Factor Services[b]	Nonmarketed Final Services[c]
	Reproducible Capital		
Tangible, Privately Owned	Services of business-owned plant and equipment to industry and commerce	Major service flows not identifiable	Owner-occupied housing
			Services of business-owned capital
Tangible, Publicly Owned	Services paid for through user fees	Factor services of infrastructure to industry and commerce	Services of infrastructure to households
Human	Services of labor paid for by wages and salaries	Volunteer services	Other nonpecuniary services of education
	Natural Capital		
Environmental	Marketable permits for use of the waste disposal services of the environment	Waste disposal and other services of air, land, and water	Effects on health, aesthetics
Renewable Natural Resource	Food, lumber, water, and recreation paid for by user fees	Major service flows not identifiable	Other recreation services, biodiversity, nonuse benefits
Nonrenewable Natural Resource	Energy, minerals, water, and recreation paid for by user fees	Major service flows not identifiable	Recreation services, nonuse benefits

SOURCE: Congressional Budget Office.

a. Underground market activities, such as illegal drug sales, are not included in gross domestic product (GDP) and are not represented. Marketed factor services add value to GDP, which is recorded in the accounts.

b. The value added to GDP by nonmarketed factor services is not identified separately in the accounts.

c. Nonmarketed final services are not included in GDP except for housing, which is assigned an imputed value.

Nonrenewable natural resource stocks include reserves of mineral fuels (petroleum, natural gas, coal, and uranium), nonfuel minerals (namely lead, copper, and gold), and groundwater. Nonrenewable resources provide inputs for the production of energy and metal products.

Capital services provided by environmental and natural resource assets also contribute to the production of goods. The current accounts, however, do not contain separate accounting entries for the value of these flows.

The Flow of Final Services from Capital Stocks. Assets can also generate service flows that go to households (final users) rather than to businesses as primary inputs to production. The services of these assets are labeled nonmarketed because they are not usually bought and sold in established markets and are not included in GDP. Owner-occupied housing and financial services are the only final service flows from capital that are currently recorded in the accounts. Including other final services of capital would require expanding the definition of GDP.

The Golden Gate Bridge and Empire State Building, for example, contribute to the ambience of San Francisco and New York in ways that differ from their services as contributions to the production of other goods and services. The final services of education, such as informing the citizenry and heightening people's appreciation of historical sights, are also nonpecuniary.

Natural resources and the environment derive much of their social value from the aesthetic, recreation, and health benefits they provide--for example, the Grand Canyon and clean water. The fact that people appreciate clean air and water and unspoiled land is demonstrated by the recreational choices they make. The benefits of beaches and mountains are examples of final services to households. Many natural resources also provide nonmarketed final services known as nonuse benefits. The willingness of individuals who may never actually see a blue whale to spend money to protect them is evidence that these services are considered valuable to the final user.

Investment and Depreciation

One of the fundamental principals of national accounting is that income and capital must be measured separately. The flow of capital services from capital stock generates income. If you liquidate your capital assets and use the proceeds for consumption, you are living beyond your means, thereby undermining your ability to create future income.

In accounting for capital assets, the accounts record changes in the stock of capital. Changes in the stock of capital are affected by investment and depreciation (among other things). Investment represents expenditures for augmenting the capital stock and is made at the expense of current consumption to ensure future income. The use of capital to generate output causes wear and tear, and hence depreciation from use of the capital stock. Therefore, the entire total of the factor incomes of all capital services (recorded as GDP) cannot be used for current consumption. Some gross income must be set aside to restore the stock of capital. As a result, the current accounts depreciate physical capital assets--equipment, machines, buildings, and so on--in the accounts. Net domestic product (NDP), calculated by subtracting capital consumption (an estimate of the amount needed to maintain the stock of capital) is an attempt to separate out income that can be used for current consumption.

The term "fixed capital" is used in the accounts to represent a depreciable capital asset, the service flows of which add value to GDP. One method of revising the accounts requires an analogous treatment for natural resource and environmental assets. Some analysts have suggested that certain forms of natural resources and the environment be treated as inventories rather than fixed capital (see Appendix C). There may be some differences in measurement techniques because of the special nature of various forms of natural capital assets. For example, no amount of investment will increase the amount of a finite (nonrenewable) resource; however, money can be spent to discover additional supplies. In the case of renewable resources such as forests, regeneration must be accounted for in assessing the size of the stock.

Asset and Production Boundaries

Asset and production "boundaries" define the set of goods and services that are included in the national accounts. The asset boundary contains real assets that include fixed capital.[3] An asset must be included in the asset boundary if it is to be assigned a value in the balance sheets. It must also be designated as fixed capital if its depreciation from use and accidental loss is to be subtracted from GDP. The production boundary delineates the set of goods and services that are treated as either intermediate or final products. Only final products in the production boundary are counted toward GDP.

3. Inventories and financial assets (stocks, bonds, and so on) are also recorded in the balance sheets of the accounts.

Current Production and Asset Boundaries of U.S. Accounts

The gross domestic product includes most final goods and services involving an exchange of money (a market transaction). A number of marketed activities are not reflected in the present taxonomy because they are a part of the underground economy. Examples include illegal activities such as drugs, prostitution, and gambling; but underground transactions also include payments "under the table" such as paying baby sitters and home health care workers in cash. These are market activities that some estimate to be as much as 13 percent of GDP. Few advocate incorporating such illegal activities in GDP.

The GDP also equals the income earned from all the factor services used in the production of these final goods and services. These services are also included in the production boundary. Some factor services that add value to GDP are, however, nonmarketed. These services have no market price and are not recorded in the accounts. Nevertheless, they do affect GDP through productivity.[4] Nonmarketed factor services that affect the value of GDP and are therefore inside the production boundary include the services of publicly owned reproducible capital; the factor services--human capital--of volunteers; environmental waste disposal factor services; and the factor services from natural resources.

Finally, most final services of capital are not included in the production boundary and are therefore not counted in GDP. The major exceptions are services of owner-occupied housing and services of financial institutions whose value equals 9 percent of GDP. These final services are assigned a value in the accounts based on imputed prices.

The current asset boundary shows that the accounts only recognize privately owned capital that is tangible and reproducible, including housing (see Table 2 on page 22). Other forms of capital--publicly owned reproducible, human, and natural--are not included in the asset boundary. This means that the current asset and production boundaries are inconsistent because the current production boundary implicitly or explicitly counts the factor services of publicly owned, human, and natural capital. This inconsistency means that the balance sheets do not record investment or depreciation for some kinds of capital stock whose factor services affect GDP.

4. For further explanation, see Jan Bojo and others, *Environment and Development: An Economic Approach* (Dordrecht, Netherlands: Kluwer Academic Publishers, 1992), pp. 40-53.